DOCUMENT RESUME

ED 103 308 SO 008 154

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TITLE	Non-Formal Education as an Alternative to Schooling. Program of Studies in Non-Formal Education Discussion Papers Number 4.
INSTITUTION	Michigan State Univ., East Lansing. Inst. for International Studies in Education.
SPONS AGENCY	Agency for International Development (Dept. of State), Washington, D.C.
PUB DATE	74
NOTE	29p.; For related documents, see SO 008 151 through SO 008 155
EDRS PRICE	MF-$0.76 HC-$1.95 PLUS POSTAGE
DESCRIPTORS	Curriculum Design; *Educational Alternatives; *Educational Development; Educational Planning; Institutional Role; *Nonformal Education; Problem Solving; *Relevance (Education); School Design; School Planning; *School Role; Systems Approach
IDENTIFIERS	*Systemic Capacity

ABSTRACT

The two essays contained in this discussion paper examine means for determining alternatives to formal education. "The Strategic Uses of Comparative Learning Environments" assumes that different environments are conducive to accomplishing different goals. In the future there is a need to find out more about the structural properties and construction of learning environments and to achieve a better fit between educational means and ends. Eight structural elements that affect learning environments are listed: the age mix and social composition of the adults and children; the nature of the reward structure; the proximity of the situation to action, meaningful work, use, and normal living; the timing of the experience with respect to employment; abstract versus concrete content; and the duration of relationships. "Systemic Capacity as a Problem in the Design of Alternatives to Formal Education" presents a hypothetical schooling model made up of the "givens" of schooling. These givens include evaluation, schooling as means rather than end, certification, time-performance accounting, literacy, content specificity, pedagogical transactions, and demand for an acculturating mechanism. The systemic capacity, or range of things that the learning environment can do, is gauged by possible variations in these givens. A question list is included to form the backbone of a correlation of structure and function within the idea of systemic capacity. (JH)

ED103308

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

program of studies in

non-formal education

discussion papers

number 4

NON -FORMAL EDUCATION AS AN ALTERNATIVE TO SCHOOLING

michigan state university

east lansing

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program of studies in **non-formal education**

discussion papers

NUMBER FOUR

NON-FORMAL EDUCATION AS AN ALTERNATIVE TO SCHOOLING

The Strategic Uses of Comparative Learning Environments

Cole S. Brembeck

Systemic Capacity as a Problem in the Design of Alternatives to Formal Education

Marvin Grandstaff

These reports are published by the Program of Studies in Non-Formal Education at Michigan State University.

The Program of Studies is made possible by a grant (AID/csd 3297) from the Agency for International Development.

1974

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ABOUT THIS SERIES . . .

Tnrough this series of reports we invite readers interested in non-formal education to react to our work and to contribute toward building a new and exciting field of inquiry and practice. These preliminary reports aim at making as explicit as possible some of the crucial issues in the theory and practice of non-formal education. While they represent considerably more than exploratory thinking, we do not think of these statements in any sense as final. Developmental would be a better word to characterize a field still so open to definition and so diffuse in conception and practice.

A word about the Program of Studies in Non-Formal Education at Michigan State University may be in order. The Program, under the sponsorship of the Agency for International Development has the basic purpose of building a systematic knowledge base about non-formal education in response to the growing need for authoritative information about this mode of education in the developing countries. There are nine areas of study: (1) historical perspectives, (2) categories and strategies, (3) country comparisons, (4) learning effectiveness, (5) economic factors, (6) case study survey, (7) model feasibility, (8) administrative alternatives, and (9) participant training.

Teams of faculty members and research fellows in a number of academic disciplines are working on the nine subject areas and the papers in this series represent portions of their production.

We invite responses to these papers as an important means of helping us critically to examine our work in a new field only now being given real form and substance.

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June 14, 1973

THE STRATEGIC USES OF COMPARATIVE LEARNING ENVIRONMENTS

By

Cole S. Brembeck

The purpose of this paper is to inquire into the comparative characteristics of two types of learning environments as a means of assessing their capacities to produce educational outcomes. The types of learning environments are formal and non-formal. The argument runs like this: All learning environments possess structural properties which set the limits of their capacities to perform educational tasks. Thus, some learning environments are "naturally" better at doing some things than others. In the past educational functions have been allocated to those learning environments called schools without much thought to their capacity for living up to expectations. It was assumed that they could. Reasons for failure were sought in the methods employed, rather than in the environmental system itself. In the future we will need to (1) find out more about the structural properties of learning environments which seem to influence educational outcomes, (2) learn how to construct learning environments with an array of

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structural capabilities, and (3) achieve a better fit between educational means and ends.

To my knowledge there exists no satisfactory description or formulation of the structural characteristics of learning environments that tells us very much about their capacities to perform. In this paper I hope to probe this obscure region or at least walk around it and survey its boundaries. In order to do this I will focus on the learner's total experience in the learning environment, rather than just on the instruction he receives. I am as interested in what is "caught" as in what is taught. Instruction is so obviously associated with learning that we find it difficult to ascribe the power to teach to other forces. But there is far more to learning environments than instruction. The total social context, of which instruction is one part, teaches, and that quite powerfully. It is this larger context, I believe, that sets the capacity of the learning situation to achieve, or not achieve, educational outcomes.

There are probably a number of good reasons for inquiring into the performance capabilities of learning environments. It grows out of the trouble the schools are in both at home and abroad. The crisis in the schools has exposed the flaw in our diagnostic skills. We need to know more about where to look for the trouble and what to do about it once we have found it.

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That the schools are in trouble is of concern, but of more significance is that their trouble stalks them even after such great efforts to keep ahead of it. New money, projects and programs have been injected in educational systems at almost unprecedented rates during the decades since World War II. Yet these are the decades of deepening crisis. It may be a good time to ask: Did we expect too much? Did we overload the system? Did we focus on social need and its translation into educational terms to the neglect of institutional means?

These questions become meaningful in the world-wide context of schooling. Most countries have expanded their educational systems almost to the financial breaking point. Their motivations for doing so have been various. Sometimes it has been a political response to rising educational aspirations. Frequently it has been a sincere desire to lift the levels of literacy. Many times expanded schooling has been seen as a means of economic development through improved manpower. Whatever the motivations, the quantities of money, time and energy consumed in developing educational systems has been unprecedented during recent years. Yet, in spite of these all-out efforts the performance of the schools must be disappointing to many. Especially disappointing are their high rates of "wastage." In fact, in half the countries of the world half the children who enroll

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in school fail to complete the primary cycle. The heavy investments in these children are largely lost.

Another concern is the apparent inability of the schools to relate themselves meaningfully to their communities. A great deal of effort in the developing countries, for example, has gone into rural schooling. Some months ago UNESCO asked a colleague and me to review the rural school literature and experience as guidance for future planning and programming. The high hopes that the rural school could help transform rural life seems forlorn. One searches almost in vain for models of schools in the countryside that are different in any major way from those in the city. Their relationship to rural need tends to be either non-existent or tenuous at best.

It is common to blame these schools for their wastage of students and their rigid insensitivity to their surroundings. Crash programs have been launched to increase their holding power by recruiting and training better teachers and by developing rural-oriented curricula. Most have been failures. Perhaps it is time to raise some prior questions: Do these schools have the structural capacity to perform as we expected them to? Did we bet on the right institution in the first place? What would education in the countryside of a developing country really have to be like if it were to have a good chance of contributing to the improvement of its surrounding community?

There is a third reason for raising the question of the structural capacities of educational environments. This is a time of searching for educational alternatives. In the past educational planners have really not been that at all; they have been planners of schools. The assumption was that that is what educational planners do: plan for schools.

The concept of alternatives, however, holds the prospect for using an array of available and thinkable educational resources. Selection from among alternatives becomes a crucial matter and there is the need to have rather carefully thought out criteria for selection. One criteria, it seems to me, is the inherent capacity of the alternative to do the job one expects it to do. Thus, the planner's work must now transcend a single medium, schools, and become the art of mobilizing all available educational resources, each according to its unique capacity to perform the particular task at hand as effectively and efficiently as possible.

THE STRUCTURE OF AN EDUCATIONAL ENVIRONMENT

Perhaps it is time to ask: What are the structural elements in learning environments which seem to have some bearing on their capabilities to foster educational outcomes? Any learning environment may be characterized in a variety of ways. Here the attempt is to sort out those elements which seem to have the most to do with performance objectives:

1. The age and age-mix of the persons in the environment. A school has a high ratio of children to adults, a family a low ratio. I am assuming that the capacities of schools and families as learning environments are quite different due to this marked variance in this particular structural characteristic.

2. The social composition of adults and children. The influence of economic status, family background, and educational aspirations are generally recognized as potent determiners of educational outcomes.

3. The nature of the reward structure. I am especially interested in whether the rewards are immediate or deferred and whether they are valued as real or symbolic.

4. The proximity of the learning environment to action, meaningful work (or play) and to use. Learning environments which provide access to action and use are quite different structurally than those which do not. This is the difference between a classic grammar school and an apprenticeship program. They produce quite different educational outcomes.

5. The proximity of the learning environment to normal living. Learning environments which bracket the main activities and values of everyday existence are of quite a different order than those which do not. This may account for the total emersion of some teenagers in learning about old cars and their complete disinterest in learning about the historical period which produced them.

6. The timing of the learning experience with respect to employment. Not only is the proximity of the learning environment to normal living an important variable: Its timing with respect to employment is critical. The learning experience may be *preparatory* as most schools are; they place children in holding patterns, awaiting their joining the main stream. The learning experience may run *concurrently* with its use, as in the internship. Or, learning may *follow* work, as in the Chinese system in which workers recommend their peers for further study opportunities. These three quite different environments will, I suspect, produce quite different educational outcomes.

7. The levels of abstraction and the use of symbolic meaning. Some learning environments lean heavily on the specific and concrete, others on the abstract and symbolic. These structural characteristics, I would judge, are part of the environment's capacity to produce certain educational outcomes.

8. The duration of relationships. The pattern of a school is one of repeated association and severance, especially between adults and the young, as students move from grade to grade. On the other hand, the relationship of a doctoral advisor and his advisee is of a different order, more sustained and frequently enduring. We may assume, I think, that what is learned in these two situations will be of a different order.

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SYSTEMIC CAPACITY AS A PROBLEM IN THE DESIGN OF ALTERNATIVES TO FORMAL EDUCATION

By

Marvin Grandstaff

These comments are in installment in a conversation that I have carried forward with Cole Brembeck and others at Michigan State over the past two or three years. They are related to, but are neither bounded by nor exhaustive of, the concerns that have attracted our attention during the time we have conducted an AID-sponsored Program of Studies in Non-Formal Education. Although we have tried to address our concerns in a fairly abstract fashion, we begin with a quite concrete question--one that is of concern to quite a few people and one that seems to us imperative. In its simplest form the question is this: If not schools, then what?

At this point we accept several assumptions that shape both our acceptance of the legitimacy of the question and the way in which we respond to it. Let me begin by stating and briefly explicating three of our major assumptions.

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1. Schooling is a Limited and Finite Model of Ecudation. Contrary to much of the conventional wisdom of education, it begins to be fairly clear that schools are not infinitely plastic institutions that can be adapted to an and all educational tasks. This notion is less controversial than it once was, especially in light of the analyses presented by Coleman, Jencks, Illich, Reimer and, with special reference to the international arena, by Philip Coombs. Although there is no stable consensus in regard to just what the limitations of schooling are or why they are, it is no longer utter heresy to insist that there are quite real constraints on what sorts of things can be accomplished within the schooling mode. Schooling seems to be inextricably bound, at both the conceptual and practical levels, with a particular view of the character of the learning process and characterized by a commitment to a rather narrow range of pedagogical formulations. I have a strong suspicion that the school, as an institutional form, is inevitably associated with literacy. Other less obvious variables, such as patterns of finance and sponsorship, characteristic practices of teacher selection and preparation and so on may also contribute heavily to the limitations of the schooling model. At any rate, the case for the finite educational capability of the school seems sufficiently strong to merit its adoption as at least an investigative hypothesis.

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2. It is Possible to Construct Systematic Designs for Alternatives to Schooling. One fashion that has emerged in response to the widely publicized shortcomings of schooling is that of supposing that schooling fails because it is "structured." (Or, in a somewhat softer tone, that the school is limited to doing things that can be structured.) The upshot of that posture is the argument that the process of building alternatives must begin with a "no-planning" assumption--that alternatives to schooling must be "unstructured." The main difficulty with that view lies in the rather naive notion that learning environments can be "unstructured." If a genuinely unstructured situation is thinkable at all I am not sure that it could be described in educational terms. Rather, the proper distinction is between *kinds* of structure. Structures may vary in terms of whether they are decided on prior to or during the actual situation, whether they are built on intrinsic or extrinsic reward systems and so on, but they are nonetheless structures. Given that, it may well be that some educational functions demand situations in which there is little or no design of structure prior to the event. In other cases it should be possible to undertake at least general and schematic design efforts, along with descriptive and evaluative studies. All that is required is the assumption that at least some alternative environments are not unique in at least some respects.

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3. Analysis and Design of Alternatives Must Not Make a Tacit Incorporation of the Schooling Model. It is not surprising that many attempts to construct alternatives incorporate the schooling model, either by adopting the concept of "alternative schools" or by focusing the effort on the expansion of the activities of schools themselves. While this may be a fruitful approach in some cases it seems to us unwise to make the image of schooling a limiting factor in the study of alternatives *to* schooling. The main reason for addressing the problem of alternatives through a broad construction of "education," rather than through a narrow one of "schooling" lies in the fact that schooling, like any social enterprise, begins with a set of givens that may, at least theoretically, be treated as variables. In thinking about alternatives it may be fruitful to conceptualize as variable properties precisely some of those properties that, in thinking about schooling, are conceptualized as stable givens. Schools may, for example, take a base in literacy as a given, as I mentioned earlier. In conceptualizing alternatives, however, we might wish to regard literacy as a variable in order to think of educational efforts that accept illiteracy as a modal characteristic of learners (and perhaps of teachers as well). Or, as another example, we might want to abandon the given of teacher--learner that permeates the schooling model in order to test the possibility of co-learner

or horizontal authority models. In many cases we do not make the mistake of thinking that a conceptualization that explicates one class of phenomena is also fully capable of explicating another class, even though the two may closely resemble one another or be subsumed under a single higher-order rubric. We do not suppose, for example, that systematic constructions of painting are adequate for the explication of sculpture, even though the two have many similarities, are both sub-classes of the class, "art" and are both sometimes practiced by a single person. For one thing, we recognize that, in painting, the plane surface is a given, and the dimension of "depth" is treated as a relational, rather than as a spatial, property. In sculpture, the spatial dimensionality of the work is a variable, requiring a different conceptualization. The discussion of alternatives to schooling needs to embody a recognition of the possible utility of varying the school-model givens.

These assumptions serve both to simplify and to shape our inquiry. They provide us with a somewhat delimited, though admittedly quite extensive field--educational environments other than those that embody the schooling model. They provide an architectonic purpose--the design of alternative environments. And they suggest a rough general strategy--the inspection of the givens of the schooling model in light of their possible status as variables. This latter point is especially important and its rationale may be a

little obscure. The rationale is this: Any attribute of the schooling model that can be treated as a variable without violating the systemic integrity of the model provides a means of design within the model itself. Alternatives to schooling, then, should consider the variation of just those attributes that, in the schooling model, cannot be altered without destroying the integrity of the system. For example, some sort of evaluation of learner attainment seems to be a persistent characteristic of the schooling model. It seems reasonable to hypothesize that evaluation is a given in the schooling model. It is possible to vary the *method* of evaluation, its frequency and its criteria, but the history of schooling would seem to indicate that if we wish to study and design educational environments that treat the presence or absence of evaluation as a variable attribute we must undertake that treatment in an extra-school environment. Let me give a brief overview of some of the variables which we suspect are givens in the schooling model and then move to a discussion of what happens when they are conceptualized as variables.

THE SCHOOLING MODEL

First let me point out that, in referring to the schooling model we mean to indicate a general and abstract system of attributes and not a particular institutional setting. Some things that take place in schools--recess and interscholastic athletics, for

example--may not utilize the schooling model. Too, the schooling model may be appropriated in non-school settings--industrial training programs provide some examples. The relationship of the model to the institutional setting lies in the presence of the model as the characteristic and "official" mode within the institution. When the model is not utilized in schools the case is regarded as special or trivial (or *extra*-curricular). When industry does adopt the schooling model, the program is set aside as special.

The attributes listed here as the givens of schooling should be regarded as hypothetical and not necessarily exhaustive. Neither do we have a clear notion at present as to which ones are most powerful in determining the functional limitations of schooling. They are intended only as starting points for what promises to be a lengthy and rather complex line of inquiry.

1. Evaluation. Evaluation has already been mentioned. The assessment of learner progress, whether undertaken over very short time increments, as in programmed learning, or over much longer increments, as in the "ungraded" elementary school; whether based on all-or-nothing criteria or partial standards of performance (linear grading) and despite variation in means of assessment and the way in which assessments are expressed, seems to be a stable feature of the schooling model. This appears to be true at all levels of schooling. It appears to hold

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for all the kinds of functions to which the schooling model is applied and seems to have cross-cultural validity. (These three criteria, incidentally--stability over different levels, stability over variations in function and cross-cultural stability--form the fairly crude basis on which we identify an attribute as a given.)

2. *Instrumentality.* Schooling is seldom, if ever, an end in itself. Rather, it has its basic reward status in view of that toward which it is an instrument. This is an attribute of substantial stability, despite a long tradition that argues for the significance of learning for its own sake (the "liberal education" tradition). Furthermore, the instrumentality of schooling is largely secondary. What is learned is of indirect, rather than direct utility. Put another way, schooling is instrumental mainly as *enabling* future behavior rather than as *being* the future behavior.

3. *Certification.* Certification constitutes the integrated and integrating commodity of the schooling model. This is so, even though certification may take variable forms and be about a wide array of attributes. The completion of a grade level is a certificate that allows passage to the next grade, just as the acquisition of a license to practice is a physician's certificate.

4. *Time--Performance Accounting.* Schooling takes either time or performance, or both, as basic dimensions of design. In some cases, time is held stable for all learners with performance allowed to vary (within some standard of minimum attainment), while in other cases performance is a constant and time is allowed to vary. (The former pattern is much more prevalent than the latter.) It is not surprising that, when the design of school programs is undertaken, the questions of time and performance are usually among the first ones raised.

5. *Literacy.* Let me repeat the supposition offered earlier, to the effect that schools, historically and contemporaneously, make literacy a primary goal and the basis of other learnings.

6. *Content Specificity.* In the schooling model we are constantly concerned with the content to be learned. Content is, as Joseph Schwab has phrased it, a "commonplace" of schooling. We do not seem to think of schooling apart from content to be conveyed.

7. *The Pedagogical Transaction.* Schooling adopts a model of teaching and learning that, within some limits of variation, is highly stable over level, function and cultural context. The main features of that model, which is here termed the pedagogical transaction, are an initiating agent (teacher) and a receiving client (learner). Both of these parties to the transaction are role-defined and the roles are known and adhered to by both parties. The role-

defined structure of relationships provides potentials and constraints that help to determine the kinds of things that may be taught and learned and the ways in which those things may be taught and learned. The pedagogical transaction has been extensively analyzed and modeled in the educational literature and I will not attempt a comprehensive analysis here. There are, however, a few points that seem to merit special attention.

7.1 Acquisition. In general, schooling is limited to learner acquisition of content. Other factors, such as application of skills and commitment to either the "truth" or utility of what is learned, while they may be hoped-for outcomes of the pedagogical transaction, are not designed into the transaction itself.

7.2 Determinants of Learning. The determination of learning in the pedagogical transaction are usually assigned to qualities of the parties to the transaction, in roughly the following fashion:

7.21 Teacher Competence. The content-knowledge of the teacher, coupled with his pedagogical skill, is seen as one major determinant of learning. To increase the effectiveness of schooling, increase the competence of the teacher.

7.22 Learner Variables. There are three major attributes of learners that are seen as determining learning: "ability," background and

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"motivation." Any or all of these attributes are seen as subject to modification in the schooling context. Learning may be enhanced through ability by selection criteria; by background through a system of prerequisites and motivation by manipulation of the structure of reward and punishment.

7.23 Media and Materials. The third element that is taken to determine learning is the form in which content is placed--its media, materials and other physical and conceptual attributes. The design of content is a recurrent concern in the design of school programs and is one of the features of thinking about schooling that leads to the (probably mistaken) contention that the quality of schooling can be judged on the basis of amount of expenditure.

7.3 Vertical Relationships. The pedagogical transaction is characterized, always, by a system of vertical relationships of authority and competence. There is a master, who is superordinate to the learner, and a learner who is subordinate. The vertical relationships may be withdrawn or withheld for a period of time, as when learners move outside the domain of the teacher to operate as co-learners or when the learner and the teacher become co-inquirers into the question of what the learner should do, but

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they are inevitably reasserted at some point in the transaction and almost always figure in the evaluative phase of the process.

7.4 Relationship of Content to Teacher and Learner. In schooling, the teacher is regarded as having the content. The relationship of the content to him is of a secondary nature, with his primary concern being to convey it. For the learner, who does not have the content, the relationship between him and the content is primary, and the transmission of the content (the teacher's primary concern) is secondary. This produces a rather special kind of tension in the pedagogical transaction that is not found in some other situations, since there is no unity of *primary* relationships to create a mutuality of interest and a commonality of behavior. This feature of the pedagogical transaction may help to account for the frequency with which schools embody an adversary relationship between teacher and learner. It may also have some bearing on the fact that, with the possible exception of the level of early childhood schooling, teaching is not widely regarded as a vocationally-compelling activity. The teacher is often interested mainly in the content, but, in his teaching, his involvement with the content cannot be primary. (This should not be regarded as the only factor, since there are undoubtedly strong elements of

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sociological, political and economic sorts that serve to give at least some substance to the old saw that those who can't do, teach.)

7.5 Individualism. In the pedagogical transaction the learner is almost invariably a monadic unit, rather than a member of a collectivity. His performance, not that of a group, is at issue. His future, and not that of a group, is at stake. Educative environments directed to collectivities are nearly always "unschoolish." (This statement depends, of course, on a distinction between "collectivity" and "aggregate.") In pedagogical transactions involving a single teacher and a number of learners, the lines of relationship are almost all unilinear, running from individual learners to the teacher. Evaluation is usually competitive and nearly always individual. (This may derive, in large part, from the certification character of schooling.) The individualistic nature of the schooling model poses several quite-tangible limitations on what the school can reasonably be expected to accomplish. Furthermore, when the individualistic canon is abandoned, the schooling model loses its integrity, since evaluation, certification and instrumentality center on the attributes of individuals.

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8. The Interface Characteristic of Schooling. Finally, we come to a pervasive and perhaps highly significant feature of the schooling model. That is the fact that schooling does not seem to emerge unless some imperative exists for aculturation--for the establishment of an interface between different sets of cultural norms and practices. The cultural groupings for which schools may serve as an interface may be drawn along a wide variety of dimensions. They may be generational, with schooling providing the mechanism by means of which members of one generation make the transition to membership in the next or the transition between one culturally-defined state to the next. The grouping may be occupational, between members of an occupation and aspirants to it. Or it may be comprehensively cultural, as in the case of contact between primitive and modern societies. What is important is not whether the cultural groupings that use the school as an interface are generational, occupational, political, religious or economic but the hard fact that schooling almost always emerges when there is a demand for an interface mechanism and does not emerge in the absence of such a demand.

There are, undoubtedly, other significant attributes of the schooling model than these and, perhaps, some of the ones given here are not as significant as they might appear on first inspection. All I wish to claim is that the stability of attributes such as the ones I have listed here impose real constraints

on the capability of schooling to accomplish some important educational functions. Put another way, the "given-ness" of these characteristics serves to limit the applicability of the schooling model and to determine what will here be called the "systemic capacity" of the school as an educative environment.

SYSTEMIC CAPACITY

Let me turn now to a question that has arisen in several contexts of discourse about alternatives to schooling. We have used various terminology for the problem, such as "the strategic uses of non-formal education" and the "problem of location of function." The only merit of the ter used here--"systemic capacity" is that it seems somewhat more clearly focused than the others. The general notion is that any educative environment can do certain things but not others. The range of things an environment ("system") can do constitutes its capacity. A central feature of educational planning and design, then, involves the determination of the "fit" between some educational function and systems that are proposed as candidates to perform that function. Somewhat differently, design may sometimes involve the inspection of a function in order to decide how to construct a system that will fit the function. Finally, we may take a system as given and ask what the range of functions are that that system might be able to perform. The sort of questions we wish to ask are not dissimilar to those we might ask if we

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(1) had a journey to make and wished to know which one of available vehicles was best suited to our needs; (2) had a journey to make and wished to know what kind of vehicle to build in order to make it; or (3) had a vehicle and wanted to know what kinds of journeys we could undertake in it. Although the questions are somewhat different, they all revolve around the explication of systemic capacities. Such an explication presents a number of sub-questions and requires some distinctions. First, we need to distinguish between what I will call "structural givens"--characteristics without which a system would lose its systemic integrity and become a different system--and "free variables"--characteristics whose presence or absence do not affect the integrity of a system. (In conventional terminology, this is the distinction between "necessary" and "incidental" attributes.) The identification of structural givens and free variables enables us to make judgments about the unalterable functional limitations of a system. Second, we are also interested in possible variations within any given system--variations produced by (1) variations in the shape of structural givens; (2) presence--absence variation in free variables; and (3) variation in the shape of present free variables. This sort of analysis can give us a picture of the potentials of a system and, potentials in conjunction with limitations constitute the capacities of a given system. Third, we need to ask

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a set of similar questions about functions. For any given function we need to know what its minimum requirements are and what the array of arrangements is within which it can be accomplished. Given answers to those questions we might be able to judge the degree and strength of fit between a given function and a particular system. Fourth, and dependent on the satisfactory analysis of the prior questions, we might ask evaluative questions, such as, what is the relative contribution of the structural givens and free variables to outcomes; what is the effect of defined variations of structural givens and free variables and so on.

The analysis of systemic capacity, along the lines suggested here, is a complex task and one for which there is probably no comprehensive solution. The point of these comments is only to lay out at least some of the relevant questions for the study of systemic capacity. Let me refine the questions suggested above into a more formal listing.

1. What are the structural givens of the system?
2. What are parameters and range of possible variation for the structural givens?
3. What are the free variables of the system?
4. What are the parameters and range of variation for the free variables?
5. What is the basic set of functional limitations for the system?
6. What is the array of functional capacities for the system?

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7. What are the structural givens of the function?

8. What are the free variables of the function?

9. What are the minimum systemic requirements for performance of the function?

10. What is the array of effective systemic arrangements for the performance of the function?

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